the remarkable "mimicry" of the plane by the sycamore, will serve to indicate the amount of attention bestowed by the author on botanical subjects. The incident related on page 87, narrating how a Scotch minister caused all the daffodils in his churchyard to be mown down because his wife regarded yellow as a vulgar colour, is a curious example of mid-century "æstheticism." To those fond of their gardens, the hints given as to the kinds of shrubs and herbaceous plants that flourish best in this country will be acceptable.

With the number of subjects on which the author touches it would not be surprising if he fell here and there into error. And yet there are but two passages which we have found occasion to criticise in this respect. In the first of these (page 89) we fail to realise how ice is likely to have had any share in the transport of the remains of the Bernissart iguanodons. The other is the statement (p. 46) that the nightjar, or goatsucker, is a relative of the swallow, whereas it is, of course, to the swifts that this bird is really allied. That the statement is not due to an accidental slip of the pen is proved by its repetition on page 233. These, however, are but trivial blemishes. And to whatever page he may turn, the reader can scarcely fail to be interested in what the author has to tell him. Whether, indeed, to while away an idle half hour at home, on a railway journey, or as a companion in the field, it would be difficult to find a more entertaining and instructive work of its kind. The epithet "delightful" suits it exactly. R. L.

OUR BOOK SHELF.

Cinématique et Mécanismes, Potentiel et Mécanique des Fluides. Cours Professé à la Sorbonne. Par H. Poincaré; redigé par A. Guillet. Pp. i + 385. (Paris: Carré et Naud, 1899.)

THIS book is edited from a course of lectures given at the Sorbonne. The first part deals with the kinematics of rigid bodies in two and in three dimensions, including the theories of roulettes, of acceleration centres and of relative motion; and concludes with a chapter on simple mechanisms. These are all well-worn topics, and afford little opportunity for novelty of treatment. In the few pages devoted to finite rotations we notice, however, an elegant method of investigating Rodrigues's formulæ which is, at all events, not current in this country. The exposition is marked throughout by the author's usual facility, and the illustrations are well chosen. A severe taste might perhaps take exception to the way in which analysis and geometry are continually mixed up in the proofs, but a course of lectures intended primarily for a special class of students is not to be judged by the same canons as a formal treatise.

The second part gives, in about 180 pages of large type, a rapid sketch of the theory of the potential, the attraction of ellipsoids, hydrostatics and hydrodynamics. A number of leading propositions are introduced, but the treatment is necessarily fragmentary, and in some instances it might be difficult to account for the precise selection which has been made. The brief chapter on hydrodynamics is disappointing. We notice, in particular, that Poisson's proof of Lagrange's velocity-potential theorem is reproduced without a word of warning as to its defects; and on p. 330 we have the following mysterious sentence: "On a discuté la question de savoir si un liquide visqueux est encore soumis au théorème de Lagrange; *les opinions sont partagés!*" Again, on p. 339, the remark: "Il est impossible de déterminer théoriquement le coefficient de contraction," might surely be qualified. It is a little strange to find the labours of Stokes and Kirchhoff on these points entirely ignored, even in an informal publication like the present. The absence throughout of all reference to authorities is, indeed, to be regretted; such references can, of course, be only sparingly made in actual lectures, but they might well be introduced in the process of editing.

It would be ungracious not to add that although, from the nature of the subject, the present treatise is not likely to excite such widespread interest as some of its predecessors, probably few readers will be found to lay it down without a fresh feeling of admiration for the energy and versatility of its author. H. L.

A Contents-Subject Index to General and Periodical Literature. By A. Cotgreave. Pp. xii + 744. (London: Elliot Stock, 1900.)

THIS is an attempt to bring together and classify in alphabetical order the noteworthy contents of periodicals and some other publications.

Several indexes to periodical literature are in existence, and are appreciated by people who have cultivated the habit of verifying references. Mr. Cotgreave has produced an index which will prove a handy and inexpensive guide, and an examination of it suggests that a similar work, prepared by a body of experts instead of one man, and issued periodically, would be of distinct value.

The index is not complete—nor does it pretend to be, but it is a praiseworthy attempt to classify a mass of heterogeneous articles, books and papers into subjects. Any one desirous to know a few contributions on any subject has only to refer to the index and he will find some to serve his purpose, though not always the best. We are only concerned with the scientific subjects, and have examined the entries from this point of view. The result is not very satisfactory, for some of the best contributions to science do not appear—at any rate where we should naturally expect to find them. Why should Barff's "Chemistry" and Reynolds' "Chemistry" be selected as containing accounts of the composition of air, while many other much better descriptions have been published? Why, again, should Johnston's "Chemistry of Common Life" be the only book given under the composition of air? Under physical geography there are six titles, three of which are unimportant; the only title under natural philosophy is Mitchell's "Orbs of Heaven"; an article on cellulose is classified under natural science; Balfour Stewart's Physics Primer is the only book cited under the title "laws of electricity"; Ashby's "Physiology" is the only reference given for a description of the metric system; the British Museum catalogue and introduction to the study of meteorites is not mentioned under meteorites; and many other similar cases could be given. We understand, of course, that the index is an eclectic one, and are willing to acknowledge that much work must have been expended in its preparation; but its limitations and imperfections must nevertheless be pointed out. If it is borne in mind that the book only contains a general survey of literature, it will be found of service.

Workshop Mathematics. By Frank Castle, M.I.M.E. Part i., pp. viii + 154. Part ii., pp. ix + 177. (London: Macmillan and Co., Ltd., 1900.)

PROF. PERRY'S persistent advocacy of a system of mathematical instruction adapted to modern requirements is bearing fruit in the shape of text-books, which will probably do more to induce teachers to adopt rational methods than the most convincing statement in favour of them. Mr. Castle has already prepared a book on "Practical Mathematics" which covers substantially all the subjects in the syllabus drawn up by Prof. Perry for

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the Board of Education, South Kensington. The two little books under notice have been written in the same spirit, and contain some sections from the previous volume, but the treatment is more elementary and many new exercises are given.

In Part i. the subjects dealt with belong to arithmetic, algebra and the mensuration of parallelograms, triangles and polygons. Prominence is given to contracted methods, use of decimals, and explanations of algebraical expressions. Scales, calipers, and other simple measuring instruments are described in the chapters dealing with mensuration, and their use is well exemplified. Part ii. is devoted to logarithms, the slide rule, mensuration of circles, ellipses and irregular plane figures, volumes and surfaces of solids, more difficult algebraic expressions than are given in Part i., and the graphic representation of varying quantities. Among noteworthy points in this part may be mentioned the clear account of uses to which a slide rule may be put, the descriptions of planimeters, and the ingenious uses made of squared paper in the section on graphic representation.

The books are full of exercises illustrating the applications to every-day problems of the principles described, and at the end of Part ii. a set of tables of logarithms and anti-logarithms is given, to enable the student to work out problems by logarithms when convenient. It would be too much to say that the books contain an ideal course of mathematics for technical students, but they may fairly claim to provide far more inspiring information and serviceable exercises than can usually be found in text-books designed for use in schools.

Exercises in Natural Philosophy, with Indications how to Answer them. By Prof. Magnus Maclean, D.Sc., F.R.S.E. Pp. x + 266. (London: Longmans, Green and Co., 1900.)

THE ability to deal with quantitative results is an essential qualification of a student of physical science. Laboratory work provides some material for the exercise of this faculty, but it is often necessary to use data obtained by others, and to work out problems other than those which are afforded by the student's own practical work. Dr. Maclean's book contains numerous exercises of this character, covering most of the subjects studied in courses of physical science, and many worked-out examples of typical cases suggesting methods of solution for those which follow. Wisely used, the book will provide teachers with useful exercises in mathematics applied to physics, and will make a convenient supplement to text-books in which such exercises are not given. Many text-books do contain questions upon the subjects dealt with, but even in these cases some good additional problems for solution could be selected from the book under notice.

Tables of useful data and physical constants are printed at the end of the volume.

Memoirs of the Countess Potocka. Edited by Casimir Stryienski. Authorised translation by Lionel Strachey. Pp. xxiv+253. (New York: Doubleday and McClure Company, 1900.)

THESE memoirs cover the period from the third partition of Poland to the incorporation of what was left of that country with the Russian Empire. They deal with episodes—more or less romantic and interesting—in Countess Potocka's career, referring to journeys, Court balls, and Napoleon I., between 1812 and 1820. The authoress died, at the age of ninety-one, in Paris, where her brilliant salon held no insignificant place in the gilded pleasures of the Second Empire. There is little of interest to scientific readers in the memoirs; but one or two incidents referring to astrologers are amusing.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Inverse or "a posteriori" Probability

THE familiar formula of Inverse Probability may be stated as follows:—

Let the probabilities of a number of mutually exclusive causes or conditions $C_1\ C_2\ .\ .\ .\ C_r$ be $P_1\ P_2\ .\ .\ .\ P_r$ respectively, and the probabilities that if $C_1\ C_2$, &c., are realised, an effect or result E will happen be $p_1\ p_2\ .\ .\ .\ p_r$ respectively; then if E happens, the probability that it happened as a result of C_r is

$$\frac{P_r p_r}{\Sigma P p}.$$

The current proofs of this are unsatisfactory, more especially one based on a theorem of James Bernoulli; for even if the ordinary statements of the principle of this theorem were correct, which must be disputed, the argument by which it is applied to Inverse Probability is demonstrably erroneous.

In consequence of the difficulty felt about the usual proofs, there seems to be a tendency to drop the subject, as unsound, out of mathematical theory.

Now it would not be hard to show that there is no essential difference of principle between problems of Inverse Probability and those of ordinary Probability, and therefore it can hardly be doubted that the former should admit of as accurate mathematical treatment as the latter.

The following is offered as a proof which can claim the same rigour as the theorems of ordinary Probability, and illustrates the identity of principle in both kinds of Probability:—

Let A and B be contingencies which are not independent, then by a known theorem

$$\text{Prob. concurrence of A and B} = \text{Prob. A} \times \text{Prob. of B if A happens.}$$

Or, as it may be shortly expressed,

$$\text{Prob. A with B} = \text{Prob. A} \times \text{Prob. B if A.}$$

Similarly

$$\text{Prob. A with B} = \text{Prob. B} \times \text{Prob. A if B.}$$

$$\therefore \text{Prob. A} \times \text{Prob. B if A} = \text{Prob. B} \times \text{Prob. A if B.}$$

$$\therefore \text{Prob. A if B} = \frac{\text{Prob. A} \times \text{Prob. B if A}}{\text{Prob. B}};$$

and this is really our theorem. For put $A = C_r$ and $B = E$.

$$\therefore \text{Prob. } C_r \text{ if E} = \frac{\text{Prob. } C_r \times \text{Prob. E if } C_r}{\text{Prob. E}}.$$

But Prob. $C_r = P_r$, Prob. E if $C_r = p_r$, and obviously Prob. E $= \Sigma P p$ by a known theorem.

$$\therefore \text{Prob. } C_r \text{ if E} = \frac{P_r p_r}{\Sigma P p}.$$

Another demonstration may be given which, though a little longer, is quite simple.

If the whole number of "equally likely" cases with reference to a given contingency E is b, and the number of these in favour of E is a, then the mathematical probability of E is, of course, $\frac{a}{b} = p$, suppose.

Considered as a fraction, $p = \frac{na}{nb}$, where n is any quantity whatever.

Suppose n an integer, as a fractional value does not here concern us. We may consider each of the original "equally likely" cases as including n "equally likely" sub-cases; and then we can interpret the fraction $\frac{na}{nb}$ as we interpreted $\frac{a}{b}$, and say that there are nb new cases equally likely, and of these na are in favour of E.

Obviously, if x is the total number of equally likely cases, the number in favour of the event or contingency is px. Again, if q is the probability that E happens if C happens, this means that q of the equally likely cases of C's happening are in favour of

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